Fiber-to-the-Home

Today's true broadband solution

James Salter, President

Leonard Ray, Government Relations Committee Chairman

Fiber-to-the-Home Council

Fiber-to-the-Home (FTTH)
Today's true broadband solution

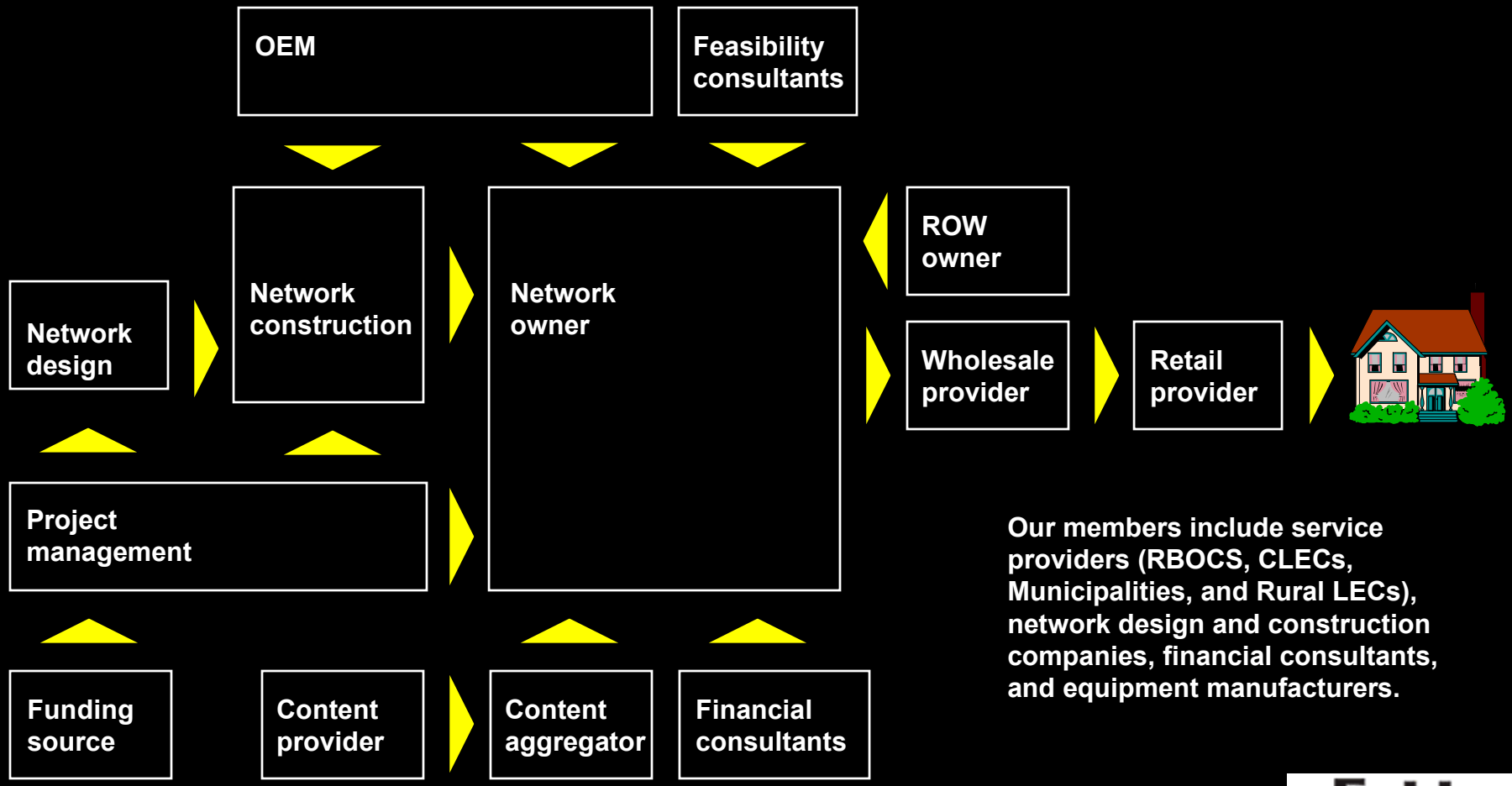
- The FTTH Council
- FTTH history
- Architectures
- Standards update
- Applications
- Cost analysis of access technologies
- The FTTH Council's public policy platform
- Summary

The FTTH Council
Visit us on the web at www.ftthcouncil.org

- Mission:
  - Educate, promote & accelerate FTTH and the resulting quality-of-life enhancements
- Objectives:
  - Supply a consistent and accurate view of FTTH
  - Promote FTTH market development
  - Be recognized by the industry as the FTTH resource
- **72 member companies**
- We represent the interests of those interested in FTTH
  - Our members are from every telecommunications group
  - We do not represent any one group

The FTTH Council

Represented in every layer of the FTTH value chain



Our members include service providers (RBOCS, CLECs, Municipalities, and Rural LECs), network design and construction companies, financial consultants, and equipment manufacturers.

The FTTH Council
72 companies - 10 active committees

- Executive Director, President, and a Board of Directors
- 10 Committees
  - Architecture and Economics
  - Communications
  - Conference
  - Finance & Audit
  - Government Relations
  - Market Segmentation Analysis & Development
  - Management
  - Membership & Nomination
  - Planning
  - Technology

The FTTH Council
Why are we here today

- We are concerned that critics are spreading untruths
  - FTTH is cost prohibitive
  - FTTH is immature
  - FTTH is not happening
  - FTTH is not necessary
- We are concerned that the emergence of FTTH is being eclipsed by the severely polarized and heated debate between the ILECs and CLECs over current-generation broadband
- We have a vision of how to accelerate the realization of the life-enhancing benefits FTTH enables by promoting facilities-based FTTH competition

The FTTH Council
What we wish to show you

- FTTH is a viable broadband solution today
  - FTTH is **not** cost prohibitive, all networks are expensive
  - FTTH is **not** immature, in fact, it has been around since the 80s
  - FTTH **is** happening, we just released a list of 50 builds
  - FTTH **is** necessary and consumers will benefit
- The FTTH Council is a serious but grass-roots organization
- We would you to think of us as your…
  - resource on technical issues related to FTTH
  - contact for every player and layer in the FTTH value chain
  - source of information on FTTH

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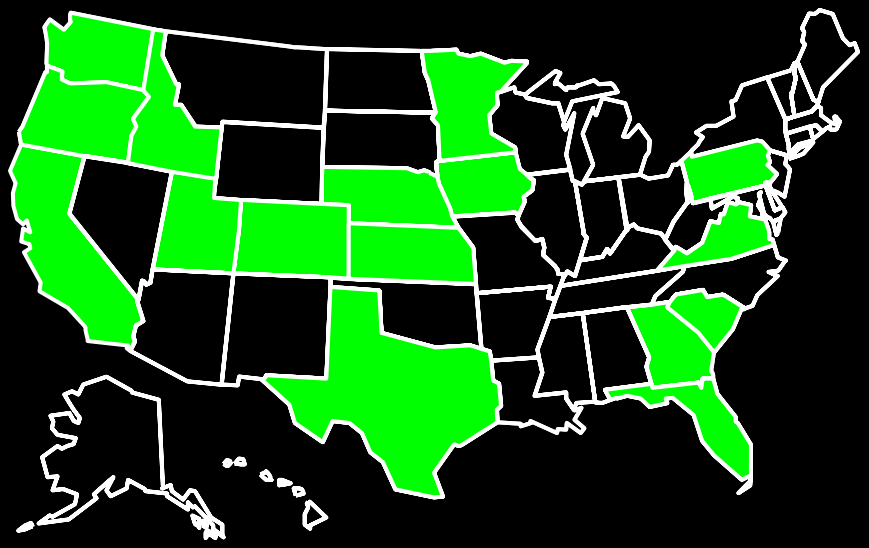
FTTH history
Trials in the 80's led to real deployments in the 90's

- FTTH has been contemplated since fiber was first installed in telecommunications networks in the early 80's
- Several FTTH trials were conducted in the 80's
- However, it wasn't until the late 90's that FTTH really began to accelerate. Largely due to improvements in:
  - Electronics
  - Fiber design
  - Splicing techniques
  - Construction methods
  - Consumer applications
  - Consumer broadband demand

FTTH history
*List of 'US Optical Fiber Communities'**

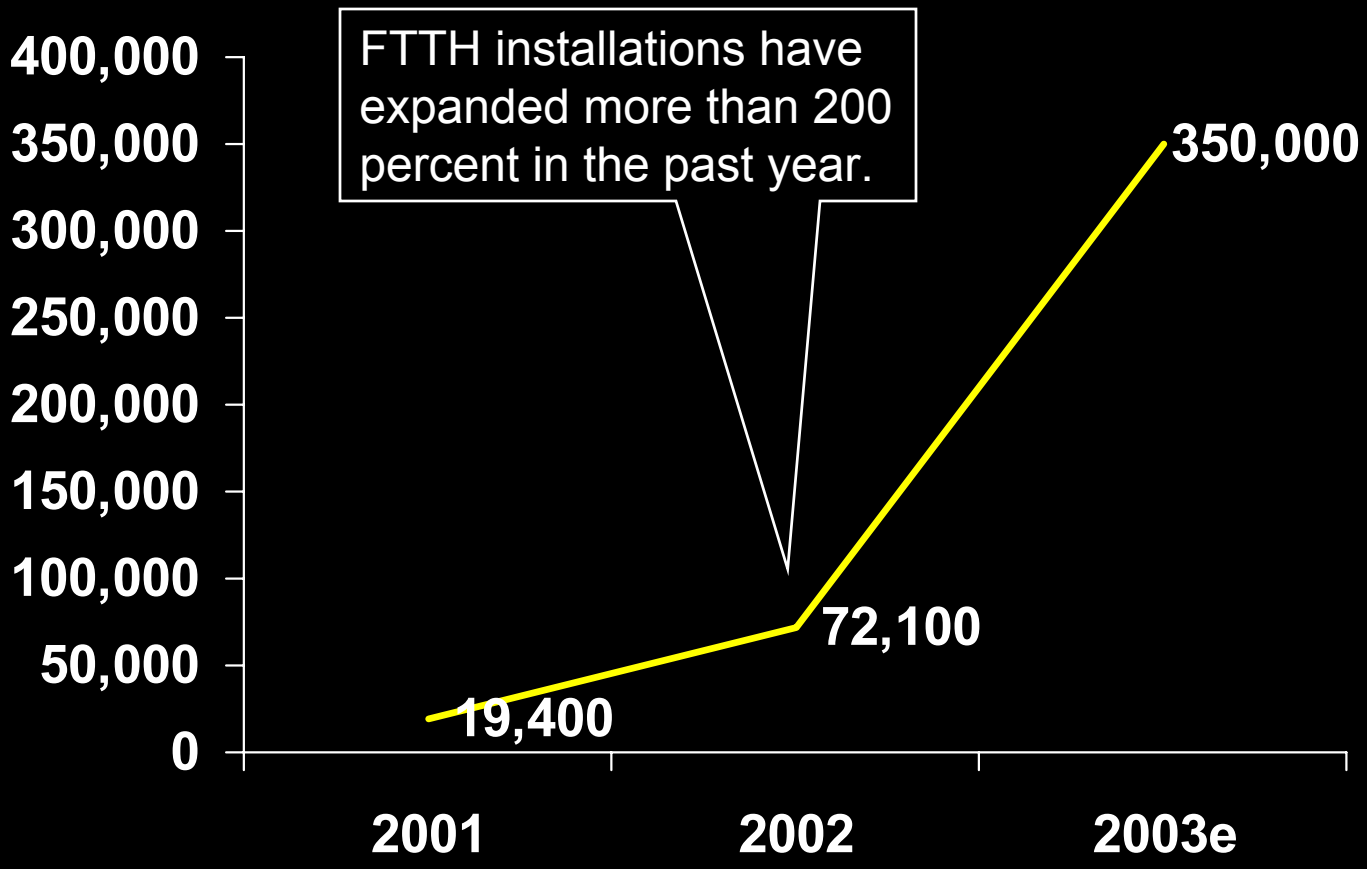


Alberta, MN
Almena, KS
Avery Ranch, TX
Bear Creak, ID
Braemer-Bristow, VA
Burleson, TX
Cambridge, IA
Canyon Gate, TX
Chelan County, WA
Chokio, MN
Colorado City, CO
Crystal Falls, TX
Daniel Islan, SC
Douglas County, WA
Dunwoody, GA
East Ottertail, MN
Evermore, MN
Grand Lake, TX
Grant County, WA
Blair, NE
Guthrie Center, IA
Hill City, KS
North Richland, TX
Huxely, IA
Issaquah Highlands, WA
Kamas, UT
Kutztown, PA
Lakes on Eldridge, TX
Lansdowne, VA
Laredo, TX
Daytona Beach, FL
Mason County, WA
Morris, MN
Houston, TX (x3)
Norton, KS
Osborne, KS
Palo Alto, CA
Poppy Meadows, CA
Prove, UT
Roseville, CA
Rye, CO
Sacramento, CA
Bluffton, SC
Slater, IA
Broadlands, VA
Albertville, MN
Woodburn, OR

* many more in construction and pre-construction phases

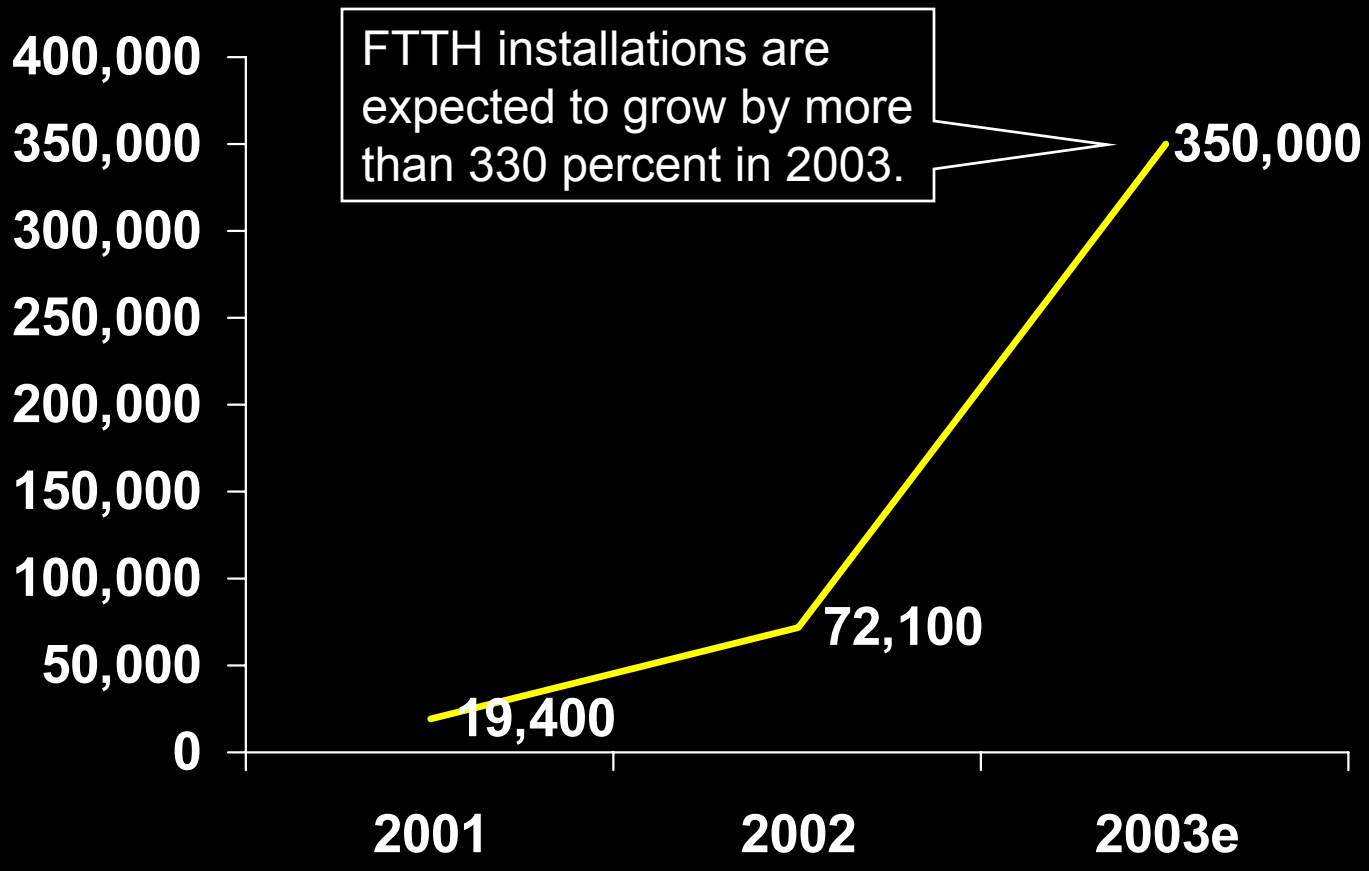
FTTH COUNCIL

FTTH history
FTTH homes passed in US and Canada



Source: Render, Vanderslice & Associates

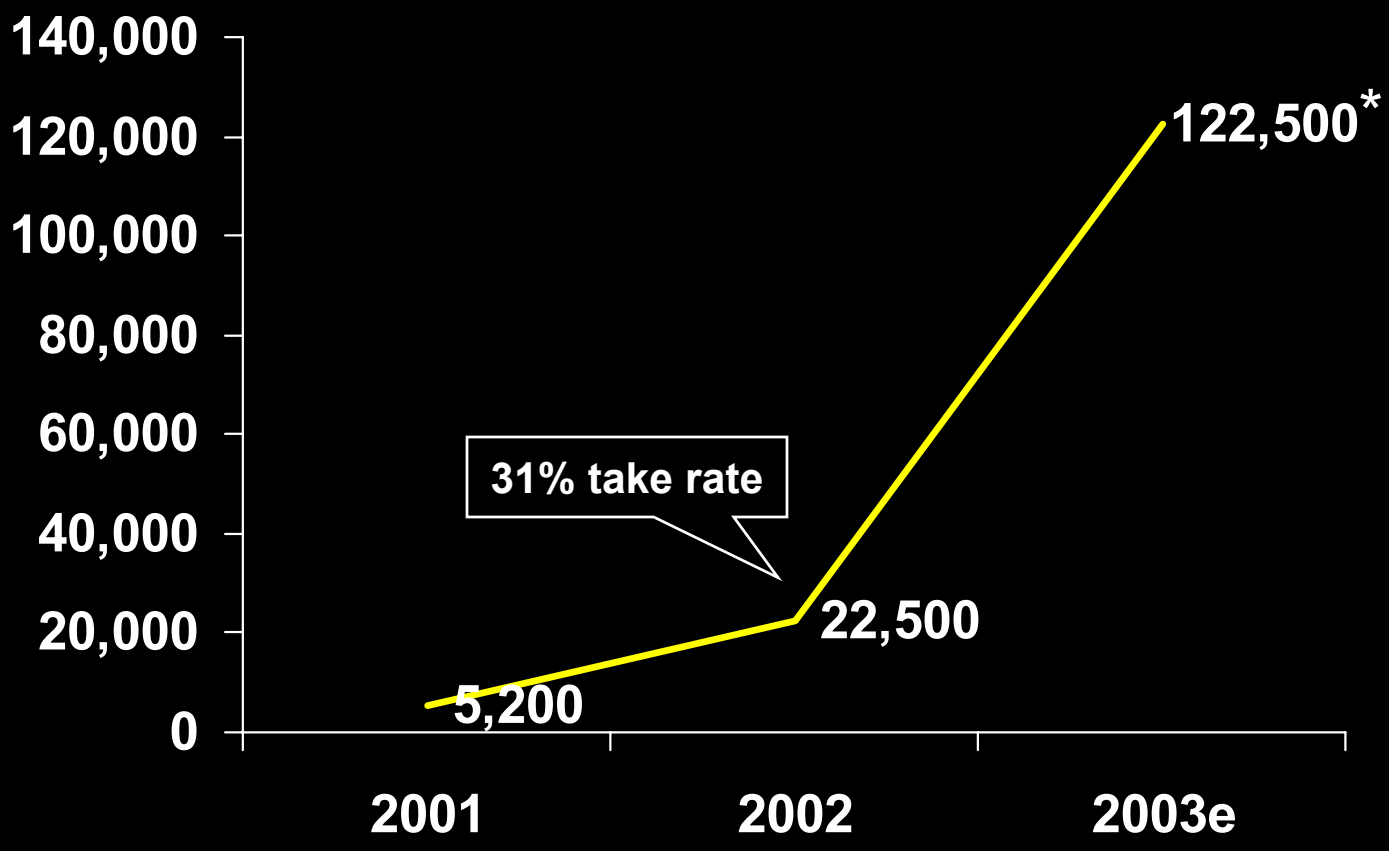
FTTH history
FTTH homes passed in US and Canada



Source: Render, Vanderslice & Associates

FTTH history

FTTH homes connected with active service



Source: Render, Vanderslice & Associates
* FTTH Council analysis of RV&A study

FCC Meeting (10/11/02)

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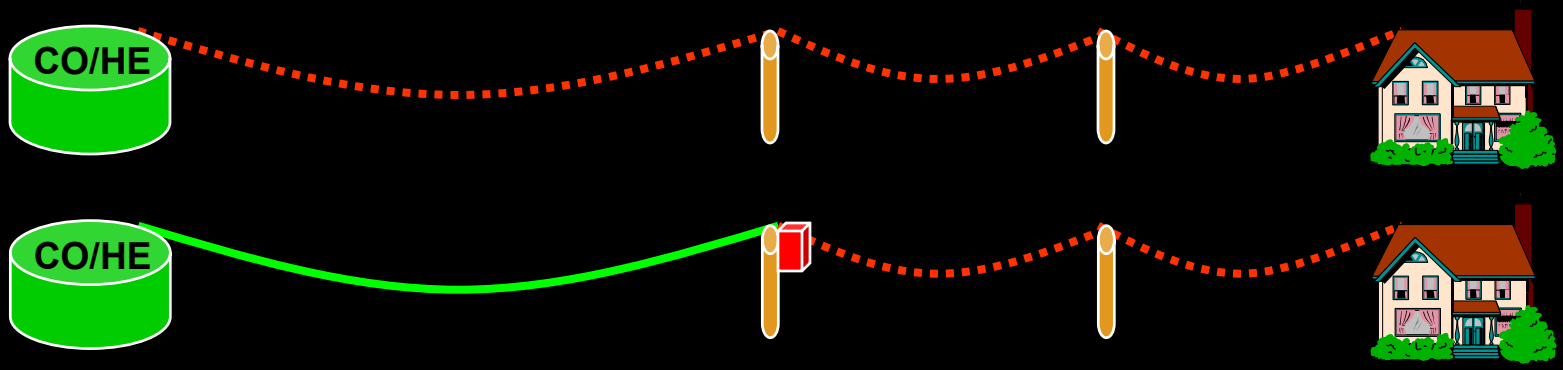
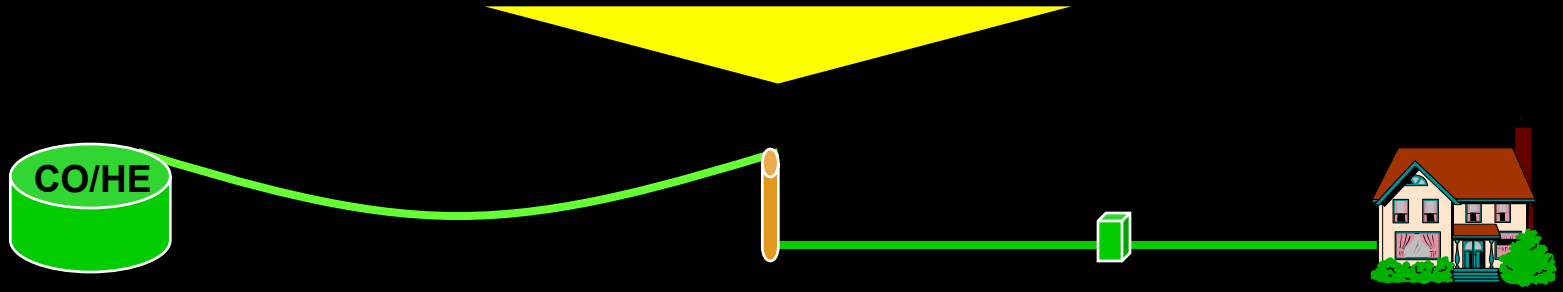
FTTH Architectures
What is FTTH?



Current or old generation, optimized for voice

24 kbps - 1.5 mbps



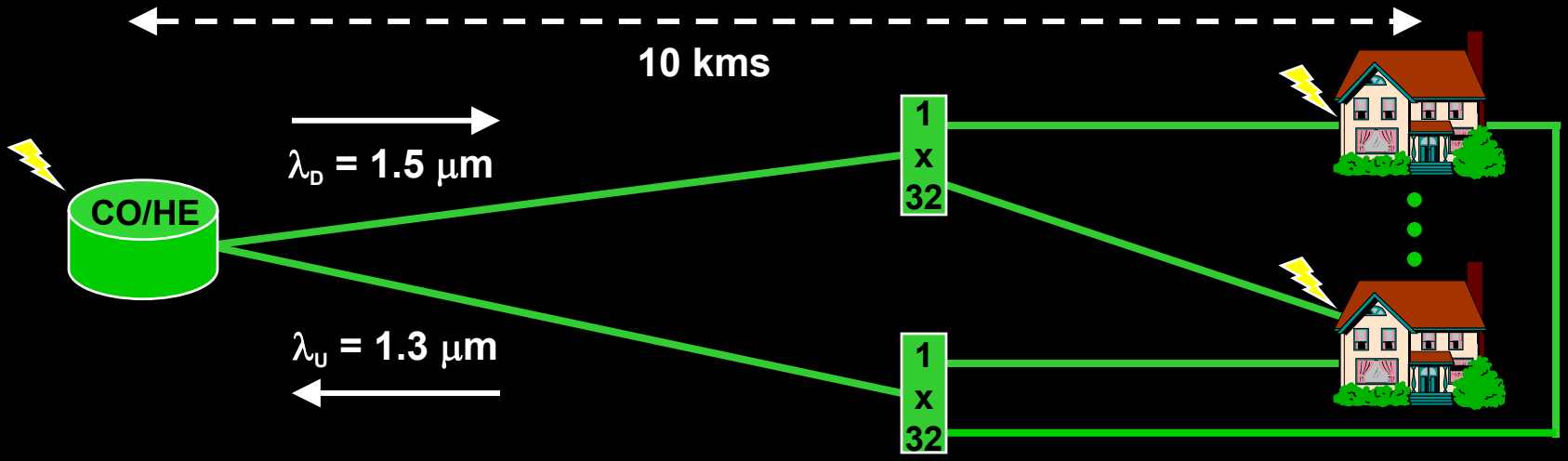
Next generation, optimized for voice, video, and data

19 mbps - 1 Gbps +

FTTH Architectures
Overview of the three basic types

- *Passive Optical Networks (PONs)*
  - Shares fiber optic strands for a portion of the networks distribution
  - Uses optical splitters to separate and aggregate the signal
  - Power required only at the ends
- *Home Run Fiber or Point-to-Point*
  - Subscribers have a dedicated fiber optic strand
  - Uses active or powered nodes to manage signal distribution
- *Hybird PONs*
  - Literal combination of a Home Run and a PON architecture

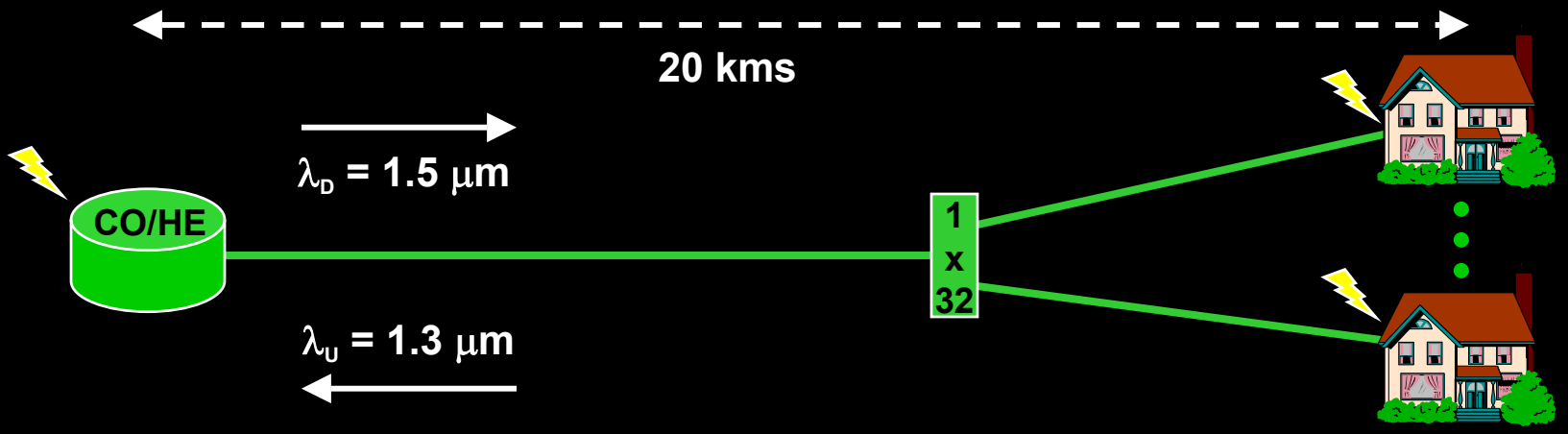
FTTH Architectures - PONs
Broadband (RF) PON (BPON)



- Services
  - Broadcast video - 80 to 100 channels
  - Voice over RF
  - 10 to 100 Mbps down / 2 to 3 Mbps up shared
- Inexpensive RF electronics
- Fiber & splitter intensive; no formal standard
- Legacy, next-generation architecture

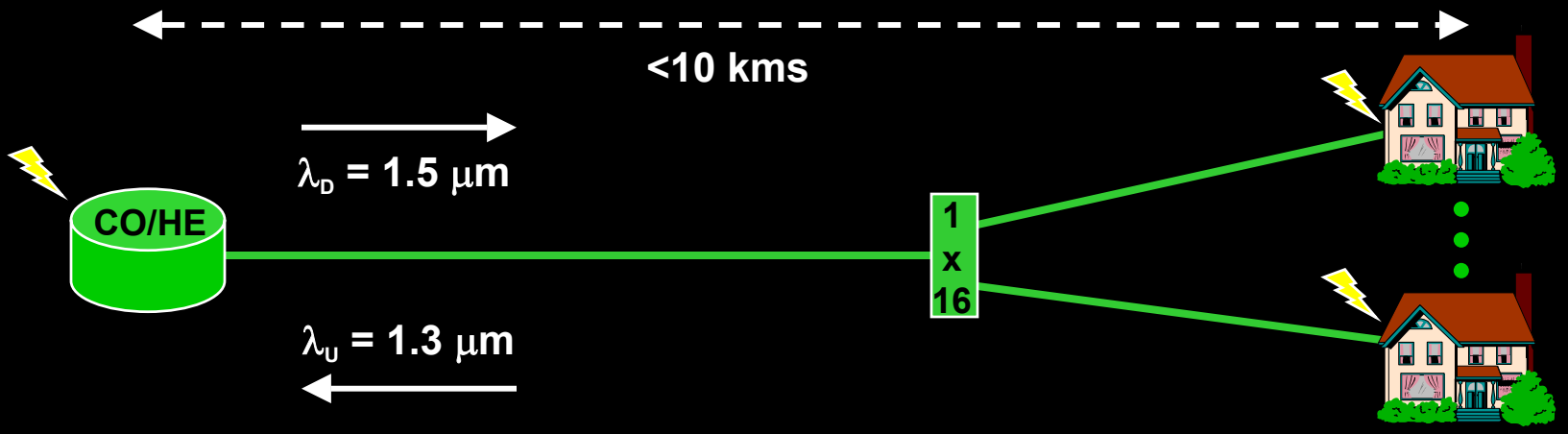
Likely to be cascaded to overcome analog transmission non-linearities.

FTTH Architectures - PONs
ATM PON (APON)



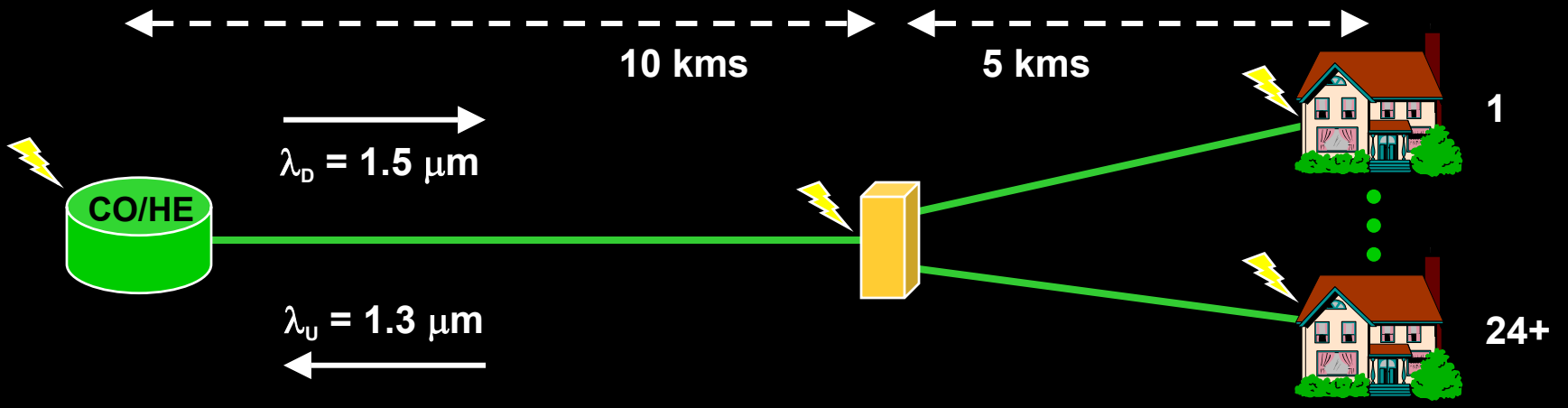
- Services
  - Digital video (with STB) or broadcast video on separate λ
  - Voice over ATM
  - 622 Mbps down / 155 Mbps up shared
- FSAN / ITU G.983 compliant (also called Broadband PON)
- Minimizes fiber & splitter count; expensive electronics

FTTH Architectures - PONs
Ethernet PON (EPON)



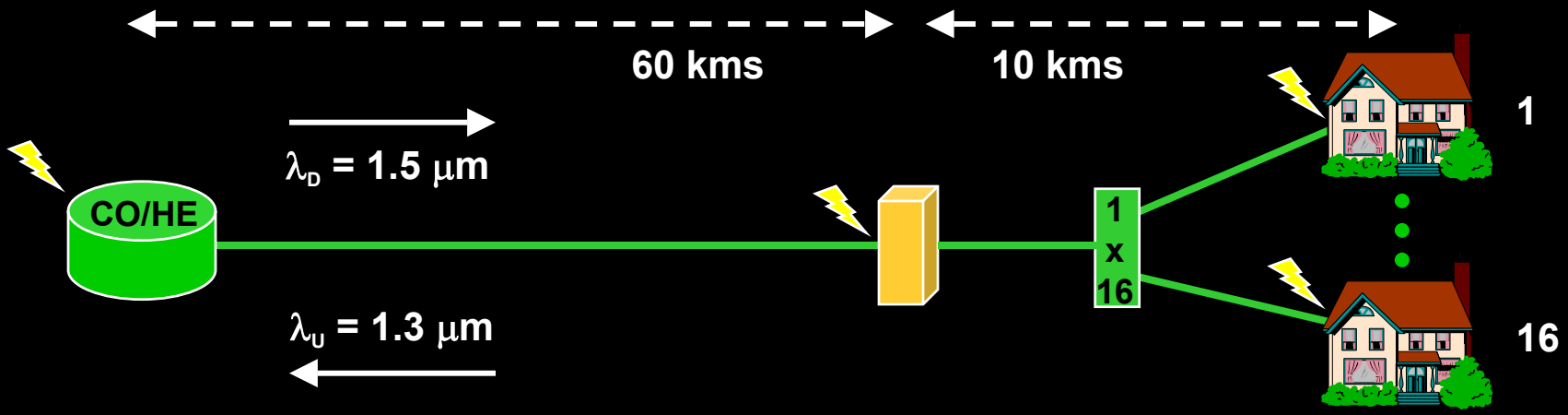
- Services
  - Digital video (with STB) or broadcast video on separate λ
  - Voice over IP
  - 1 Gbps down & up, shared; upgrade to 10 Gbps
- Adds value to home and community; “Wired community”
- BW likely to spawn new applications and services
- Limited range and splitting capability

FTTH Architectures - Home Run
Active node architecture (Point-to-Point)



- Services
  - Digital video (with STB), VOD, Interactive TV
  - Voice over IP
  - 1 Gbps down & up, ***dedicated***; upgrade to 10 Gbps
- Ethernet switch needs powering and environmental control
- BW likely to spawn new applications and services
- Architecture works well in MDU setting

FTTH Architectures - Hybrid PONs
Point-to-point-to-PON (also called active PON)



- Services
  - Digital video (with STB) or broadcast video on separate λ
  - 622 Mbps down / 155 Mbps up shared (ATM)
  - 1 Gbps + (Ethernet)
- Primary benefit is the extended reach
- Similar pros and cons to APON

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Standards update
ITU-T Q2/SG 15 G.983 series

- Only published international standard for FTTH
- Describes a Passive Optical Network carrying ATM traffic and TDMA subscriber access
- Several versions published since October 1998
  - G.983.1 - Basic ATM-PON system
  - G.983.2 - ONT management and control interface
  - G.983.3 - WDM system for enhanced services (i.e. analog video)

Standards update
History and status of ITU FTTH Standards

- Standards drafted by the Full Service Access Network (FSAN), a private working party of service providers and vendors
  - Meeting since 1995
  - Proposals submitted to ITU-T for approval and publication as an accredited standard
- Current projects:
  - Expand bandwidth to 1 Gb/s range
  - ATM or Ethernet
  - Increase network capability (span and split ratio)
  - Improve bandwidth allocation among subscribers
  - Network reliability

Standards update
IEEE 802.3ah - Ethernet in the First Mile (EFM)

- Organized informally via the IEEE 802.3 in Fall 2000
- Chartered as IEEE 802.3ah in Spring 2001
- Develop 1 Gb/s Ethernet access standards including FTTH
  - Point-to-Point (home run)
  - Point-to-Multipoint (PON)
  - Twisted pair standards too
- Publication due Q1 2003

Standards update
IEEE 802.3ah EFM status

- PON PMD based on ITU-T 983 series
- Home run PMD based on Gigabit Ethernet standard
  - Service providers and vendors disagree on exact architecture
  - Likely parallel standards to be developed
- Strong disagreements on copper standard due to incapability of installed plant
  - Copper disagreement threatens to delay entire standard by 12 months or more

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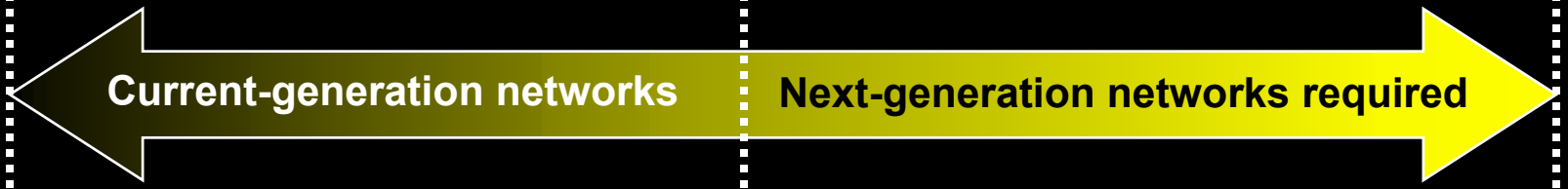
Constrained applications
Applications today are limited by bandwidth

Year	2001	2002-2003	2004-2005	2006
Bandwidth	56 kbps -1 Mbps	400 kbps - 2 Mbps	2 - 80 Mbps	80 Mbps - 1 Gbps
Applications	E-mail Static we browsing Bulletin boards Bill payment Online auctions Instant messaging	VOIP File sharing Data warehousing Supply chain mgt Video conferencing Online gaming	VOD Interactive TV 3-D multi-player games HD Television	E books Tele-medicence Distance learning Interactive shopping



Source: In-Stat, PONS, April '02

Current generation - evolved applications
Existing consumer broadband products

- Peer-to-Peer Communications
  - Sharing/sending digital entertainment files
  - Local web hosting
  - Distributed computing: INTEL™, SETI@home
- Tele-medicine
  - GE Medical Systems
  - Lemeul Shattuck Hospital
- Digital Still and Video Cameras
  - Nikon Coolpix 990 ™
  - SONY MD Discam™
- Video-on-Demand
  - Intertainer ™, MovieFlix Plus ™, CinemaNow ™
- Personal Video-Telephony
  - Polycom ™, Inetcam inc.™
- Online Gaming
  - Sony Everquest ™
  - Playstation 2, X-Box
- Tele-work
- Distance learning

Next generation - emerging applications
Future consumer broadband products

- Education
  - Video lectures on demand
  - Virtual classrooms
  - Parental monitoring
  - Text books on demand
  - Virtual libraries
- Community
  - Online voting
  - Virtual community meetings
- True tele-medicine
  - Constant in-home monitoring
  - Virtual doctor visits
- Entertainment
  - High definition TV
  - Limitless IP digital video
  - True VOD& interactive TV
  - Full graphic multi-player Internet gaming
  - Virtual museums
- Advanced security
- True tele-work
- **Many yet to be imagined applications**

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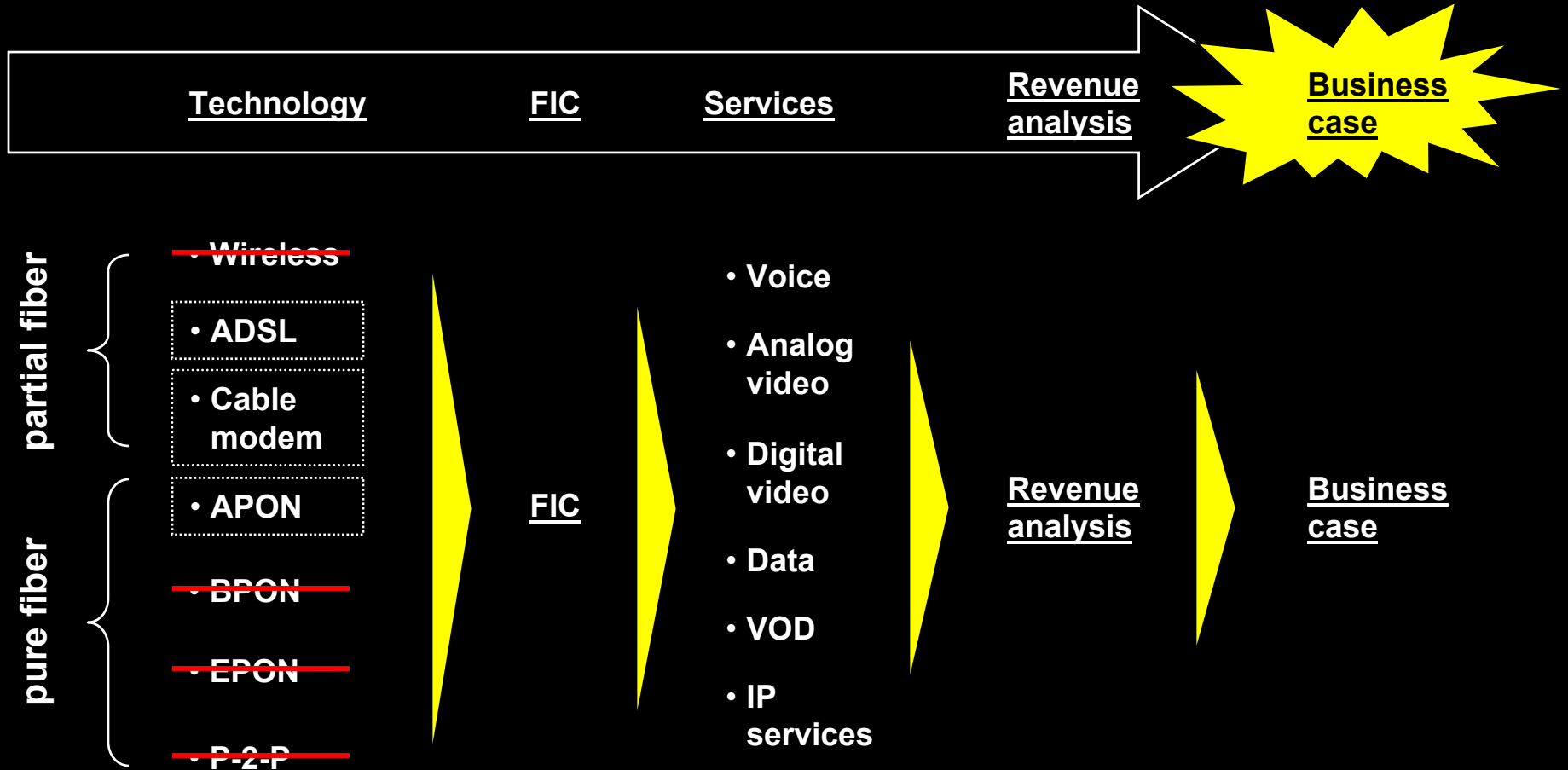
Cost analysis of access technologies
Overview of methodology



Cost analysis of access technologies
Overview of methodology

Technology		Cost per home passed	Services	Revenue potential	Avg per sub	Ratio of revenue & cost/HP with DSL as base case (1.00)
• **ADSL**	FF-NGDLC BW: 1.5 mbps	**$ 809**	Voice (w/LD) Data	$30 $45	$18	**1.00**
• **Cable modem**	500 home node BW: < 1 mbps	**$ 1114**	Data Video	$45 $35	$21	**0.87**
• **APON**	32 home PON BW: 19.5 mbps	**$ 1409**	Voice (w/LD) Data Video VOD Special Future	$30 $45 $35 $10 $5 $?	$33	**1.08**

Source: Corning Optical Fiber, New buried construction, TR for voice: 30%, data: 20%, video: 30, VOD: 15%, special: 5%, includes active electronics, OSP, and OSP installation costs, excludes cost of CO/HE facility, DSL - NGDLC serving 335 subs, all architectures built for 5000 subs, lot frontage 100 ft x 140 ft w/ 20 ft street widths

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The FTTH Council's Public Policy Platform
Four key points

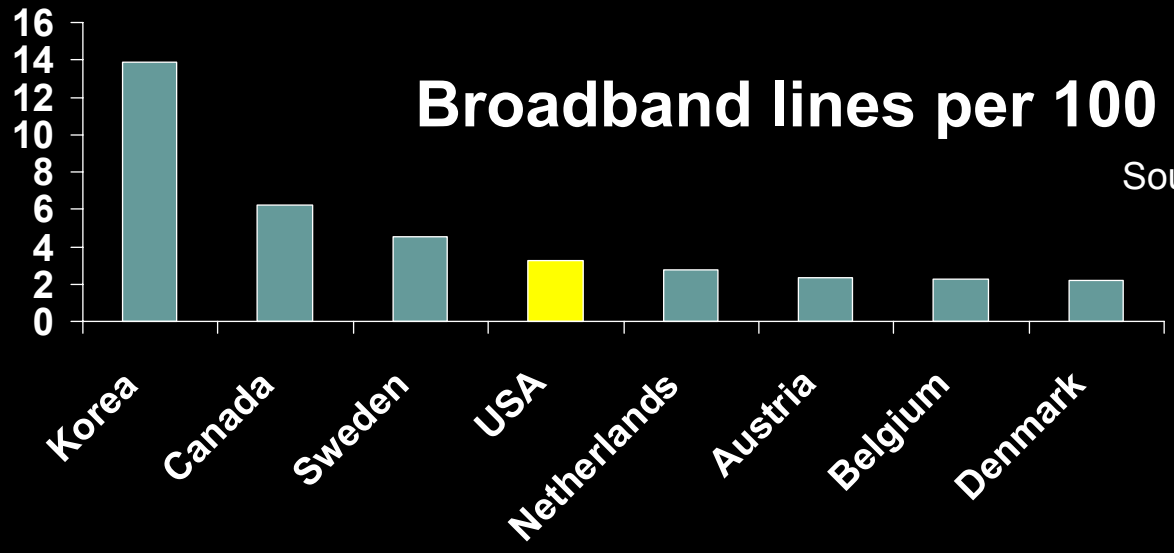
1. The US needs a national broadband policy
2. FTTH networks should be free of unbundling
3. Tax incentives are needed to accelerate FTTH
4. Any entity should have the right to deploy FTTH

The US Needs a National Broadband Policy

The FTTH Council's public policy platform
The US needs a national broadband policy

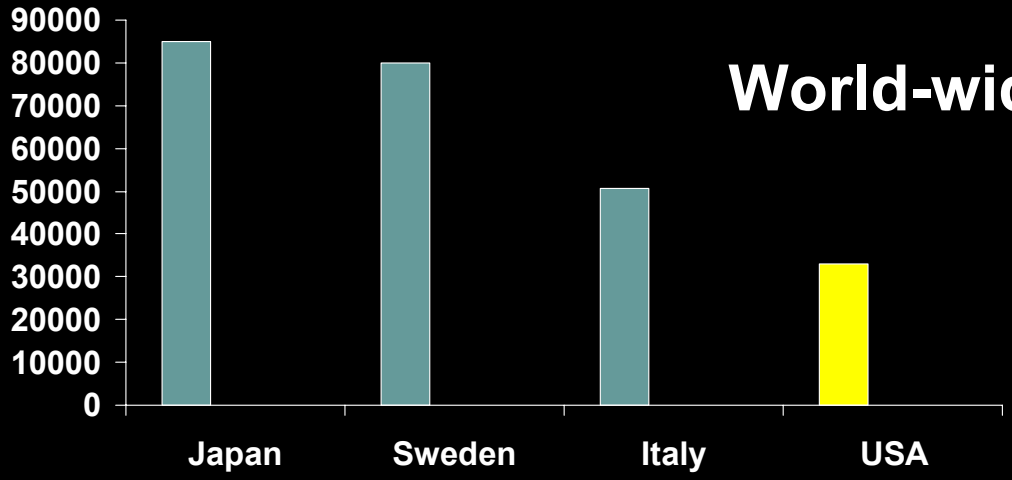
- Need a national broadband policy with the objective of serving 100 million homes with 100 Mbps service by 2010
- TechNet supports
- Information Technology Industry Council supports

The FTTH Council's public policy platform
The US needs a national broadband policy



Broadband lines per 100 inhabitants

Source: OECD Feb '02



World-wide FTTH leaders

Q302 FTTH estimates

FCC Meeting (10/11/02)

FTTH Networks Should be Free from Unbundling

The FTTH Council's public policy platform
FTTH networks should be free from unbundling

Recommendations --

- Relieve FTTH from the unbundling requirement in Section 251(c)(3)
- Pre-empt state authority to change the unbundling requirements
- Regulate voice service, but deregulate broadband service

The FTTH Council's public policy platform
FTTH networks should be free from unbundling

Rationale --

- Lack of access to FTTH will not "impair" a CLEC's ability to provide service
- FCC regs (Section 51.317(b)(i)) -- FCC will find impairment if lack of access "materially diminishes" a requesting carrier's ability to provide service, taking into account:
  - Alternative elements outside the incumbent's network
  - **Degree of self-provisioning by the requesting carrier** (emphasis added)
  - Alternative access from a third party

The FTTH Council's public policy platform
FTTH networks should be free from unbundling

- CLECs have demonstrated their ability to "self-provide" FTTH

The FTTH Council's public policy platform
FTTH networks should be free from unbundling

- CLECs have demonstrated their ability to "self-provide" FTTH

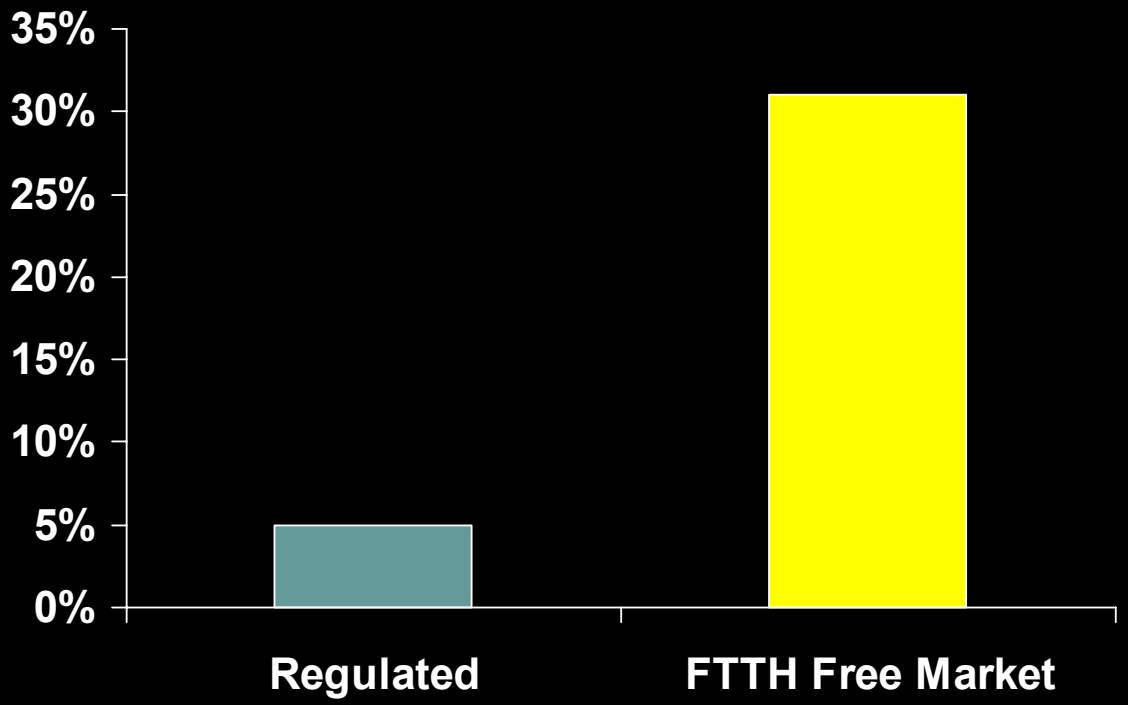
	Homes Passed by FTTH	Percent of Total
CLECs	44,890	67.0%
Small ILECs	3,600	5.4%
RBOCs	400	0.6%
Munis	18,100	27%
Total	66,990	100%

The FTTH Council's public policy platform
FTTH networks should be free from unbundling

- Other reasons to relieve FTTH from unbundling:
  - Can't unbundle a facility that doesn't exist
  - All carriers are in the same position to compete
  - Will enhance competition between ILECs and CATV
  - Will increase investment 6X according to CSMG study

FTTH networks should be free of regulation
CSMG findings were alarming

- CSMG found our proposal to free FTTH from UNE regulation would create a NPV positive business case to bring FTTH to 31% of all households



FCC Meeting (10/11/02)

Source: CSMG *Assessing the Impact of Regulation on Deployment of FTTH*, April 5 '02

The FTTH Council's public policy platform
Other supporters of Council's recommendations

- Atlantic Engineering Group
- Ciena Corporation
- Iamba Networks, Inc.
- Intertainer, Inc.
- Paceon
- Pirelli Communications Cables and Systems North America
- Eagle Broadband
- ZERO dB

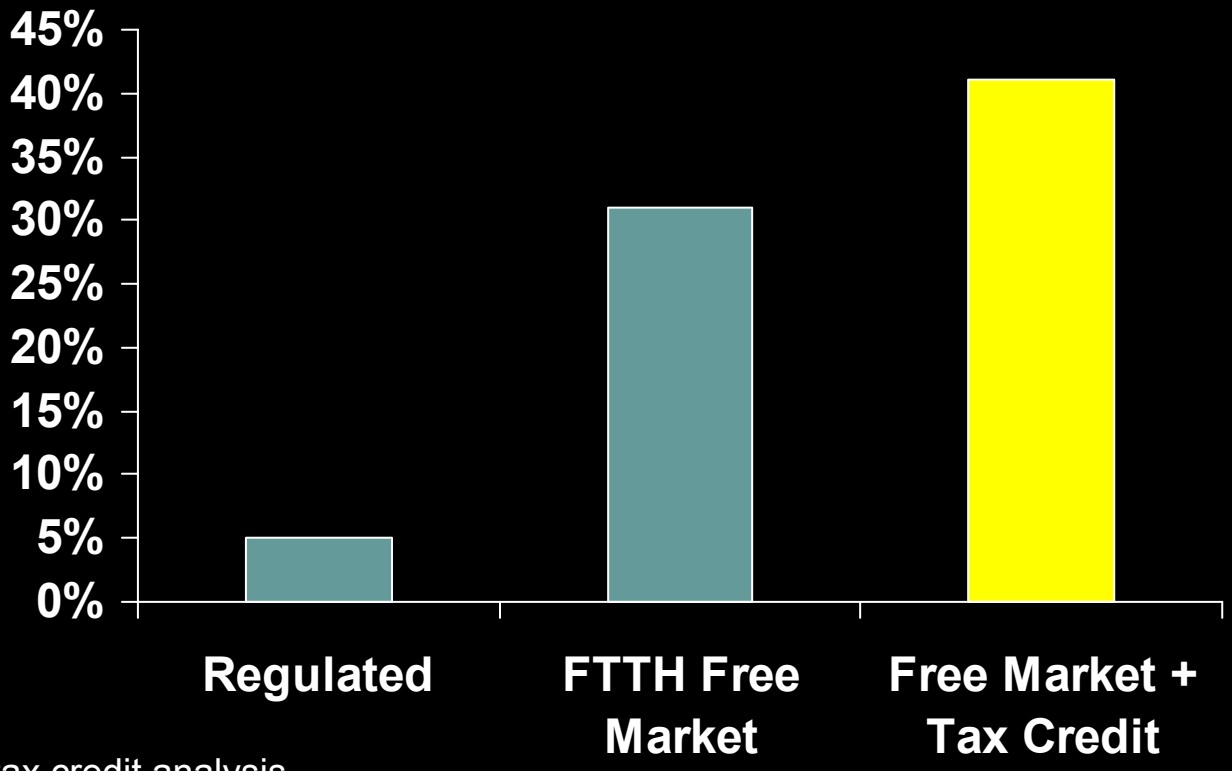
Tax Incentives Will Accelerate FTTH

The FTTH Council's public policy platform
Tax incentives will accelerate FTTH

- We are supporting the Broadband Internet Access Act
  - The credit would accrue to any service providers deploying "next-generation" broadband services to residences
    - Next-generation is defined as 22 mbps down stream and 5 mbps up stream
    - FTTH meets this classification
  - Provides 20% tax credit for next-generation broadband
    - All residents and rural business are eligible
  - Provides 10% tax credit for current generation broadband
    - Rural residents and business are eligible

The FTTH Council's public policy platform
Tax incentives will accelerate FTTH

- CSMG found a 20% tax credit combined with our proposal to free FTTH from UNE regulation would create a NPV positive business case to bring FTTH to 41% of all households



Source: CSMG tax credit analysis, April 5 '02

Any Entity Should Have the Right to Deploy FTTH

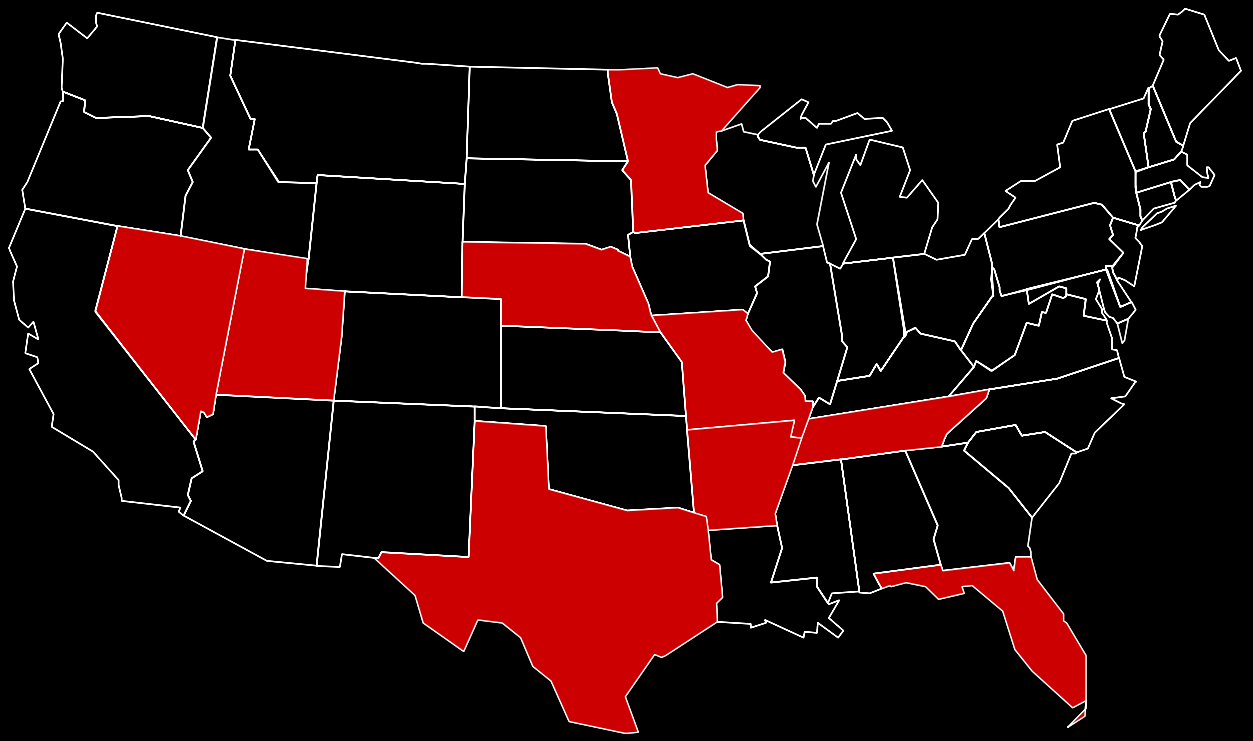
The FTTH Council's public policy platform
Any entity should be able to deploy FTTH

- The TA '96 understood this important principle for true facilities- based competition and consumer choice
- We work closely with the APPA to protect this right

> In General. -- No State or local statue or regulation, or other State or local legal requirement, may prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service.

Source: Section 253(a) of the TA '96

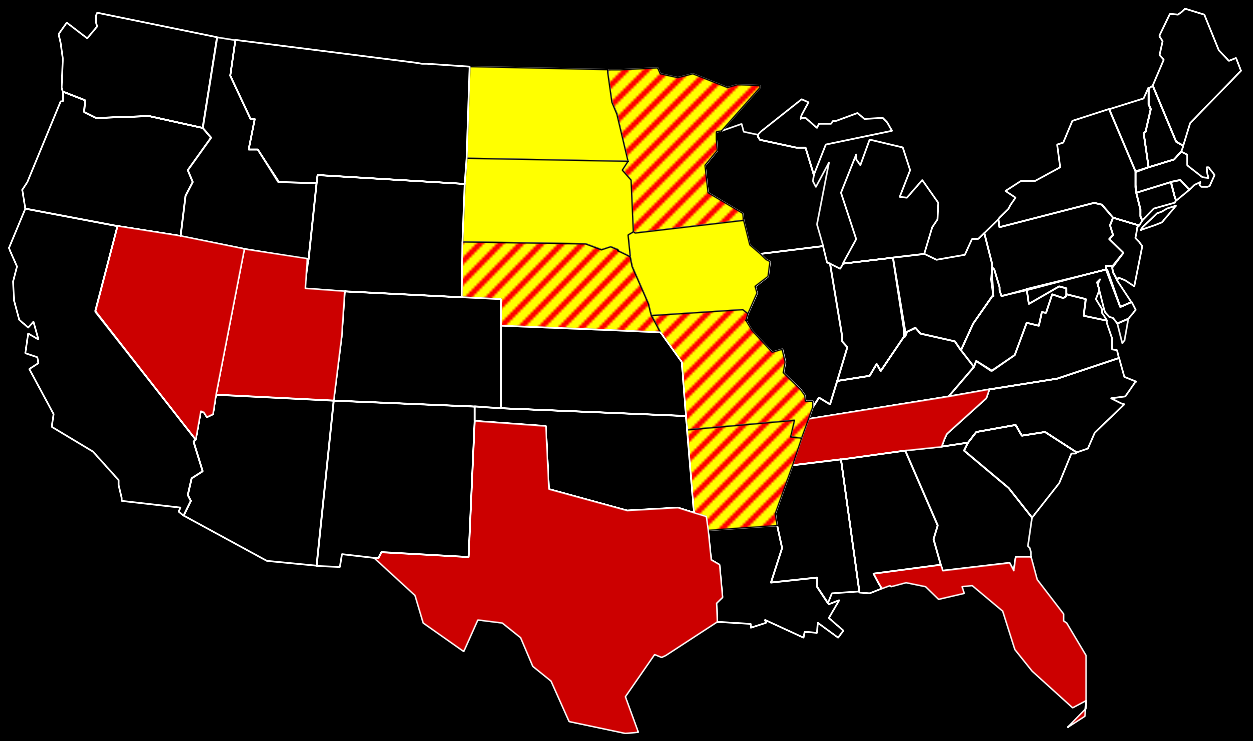
Any entity should be able to deploy FTTH
However, states are blocking some entities



- Arkansas
- Florida
- Missouri
- Minnesota
- Nebraska
- Nevada
- Tennessee
- Texas
- Utah

- 9 states have laws preventing or hindering municipalities from providing telecom services despite the Telecom Act's specific preemption wording in Section 253(a)

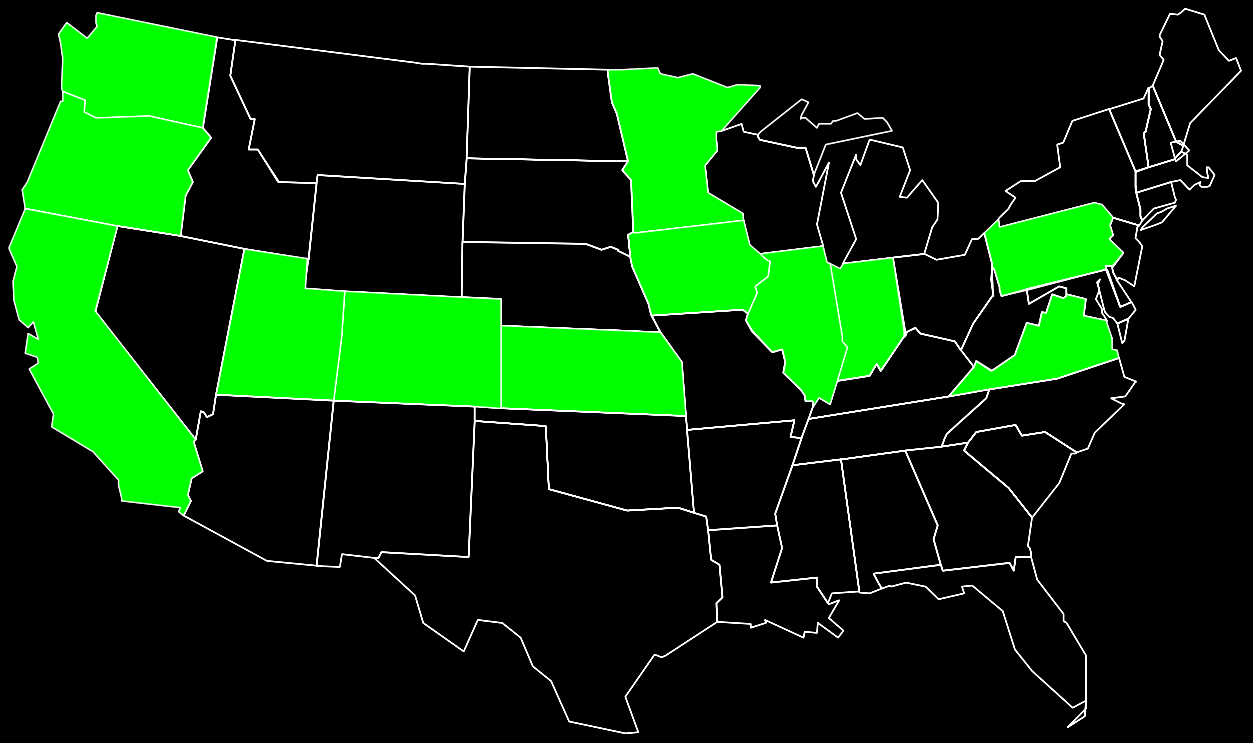
Any entity should be able to deploy FTTH
However, states are blocking some entities



- ~~Arkansas~~
- Florida
- ~~Missouri~~
- ~~Minnesota~~
- ~~Nebraska~~
- Nevada
- Tennessee
- Texas
- Utah

- 8th Circuit Court ruling vacates a decision by the FCC not to preempt a Missouri law that prevented municipalities from providing telecommunications services or facilities
- Could go to the Supreme Court

Any entity should be able to deploy FTTH
Munis - key catalyst for facilities-based competition



- 23 of the 50 ‘US Optical Fiber Communities’ are munis
- Munis are expected to grow by 675% over next two years*

* Corning Optical Fiber research, April ‘02

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- FTTH is a viable broadband solution today
  - FTTH is **not** cost prohibitive
  - FTTH is **not** immature
  - FTTH **is** happening
  - FTTH **is** necessary and consumers will benefit
- Our proposals will enable and accelerate facilities-based, true broadband competition
  - The US needs a national broadband policy
  - FTTH networks should be free from unbundling
  - Tax incentives will accelerate FTTH
  - Any entity should have the right to deploy FTTH

www.ftthcouncil.org